

Genetics in the Medical School Curriculum¹

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MEDICINE is both an art and a science. While accurate scientific knowledge is much preferred, physicians have never scorned empiricism. Genetics is the youngest of the biological sciences, yet physicians have been observing and recording the familial aggregation of certain diseases for centuries. The family physician of the 19th century often made surprisingly accurate predictions and early diagnoses, based largely on knowledge of the family history. Observations of this sort soon found their way into medical school textbooks and lectures. As evidence of the accuracy of some of these empiric observations, it is of interest to note that the early editions of Sir William Osler's textbook of internal medicine, published 10 years before the rediscovery of Mendel's work, carried an accurate description of the transmission of a sex-linked recessive trait (Osler, 1894). In his discussion of hemophilia, Osler pointed out that all daughters of a hemophiliac male are asymptomatic carriers of the condition, and also remarked on the frequent appearance of new cases in previously healthy families, which we now refer to as mutations. It was more than two decades before the cytologic basis for these empiric clinical observations became firmly established. It is also of historic interest that the applicability of Mendel's rediscovered work to man was promptly recognized by certain workers, and that Garrod (1902) was able to show that alcaptonuria is due to an autosomal recessive gene as early as 1902.

In the early days several workers attempted to apply the lessons learned from *Drosophila* and other laboratory animals to human problems, but knowledge accumulated slowly during the first quarter of the current century. It is well known that some of the studies of this period were poorly done and incorrectly interpreted, and did the cause of human genetics far more harm than good. The history of the development of research and the applications of genetic knowledge to medical problems was brilliantly reviewed by Snyder (1951) in his Presidential address to this Society as part of the Golden Jubilee Celebration of Genetics in 1950.

The medical curriculum changes only slowly, and there was little if any organized instruction in genetics in American schools of medicine during the first three decades of this century. In the early 1930's, serious proposals that genetics should be regularly taught as a basic science and as a clinical subject were made by Madge Macklin (1932), Laurence Snyder (1933) and William Allan (1936). These three should be regarded as the pioneers and prime movers in introducing genetics as a science to the schools of medicine. By means of their many formal and informal addresses to medical

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groups, Macklin, Snyder and Allan continually emphasized the practical applications of genetics to medical problems and urged the inclusion of genetics in the medical curriculum. They were soon aided and abetted in their campaign by a number of research workers and educators.

Macklin has remarked that her first teaching of genetics at the University of Western Ontario was as a "bootleg" addition to another course, which so proved its worth that a course in genetics was later established. So far as I am aware, the first regularly required course in medical genetics in the United States was organized by Snyder at Ohio State University in 1933. A few elective courses soon appeared in other medical schools, and several added occasional lectures on genetic topics as part of existing courses. In 1940 the Department of Medical Genetics at the Bowman Gray School of Medicine was organized by Allan, and Snyder gave the first group of lectures at this school, also giving the same lectures at Duke University and at the University of North Carolina. The publication of these lectures (Snyder, 1941) marks the appearance of the first book in this country suitable as a text for medical students. The establishment of the Heredity Clinic at the University of Michigan in 1941, the Dight Institute at the University of Minnesota in 1943 and the Laboratory of Human Genetics at the University of Utah in 1945 greatly increased the awareness of developments in this field in the minds of medical educators. The Universities of California, Oklahoma and Texas also became centers of influence, as well as Johns Hopkins and Tulane. The Department of Medical Genetics of the New York State Psychiatric Institute, under the direction of Dr. Franz Kallmann, has particularly influenced graduate medical training since 1935, and the cause of genetics in Canada has been advanced by the Departments of Medical Genetics in Toronto and Montreal.

The first systematic attempt to obtain exact information on the extent of genetic instruction was made by Robertson and Haley in 1946. They sent questionnaires to 84 schools of medicine in the United States and Canada, and received replies from 60. A formal course in medical genetics was offered in 7 schools, with an average of 15 class hours of instruction. Some lectures on genetics as part of other courses were given in 25 schools, with an average of 5 class hours of instruction. While the number of assigned class hours in most schools was certainly inadequate, it is encouraging that 38 per cent of medical schools assigned some time to genetics in 1946.

A second questionnaire survey was done in 1953 with the approval of the Association of American Medical Colleges (Herndon, 1954). The findings of this survey were reported to the sixth annual meeting of this Society as a part of the symposium on human genetics and medical education organized by Dr. Macklin. By 1953, some instruction in genetics was being given in 55 per cent of the 87 medical colleges in the United States and Canada. While the increase in the number of colleges offering genetic instruction was gratifying, it was also noted that the total amount of genetic instruction in more than half of these schools was still less than 5 lecture hours. The great majority of instruction was given as a part of other courses, such as anatomy or pediatrics, and the number of separate courses in medical genetics had not increased in the preceding seven years.

The comments received with these questionnaires and information obtained from

a number of other sources indicates that there has been a considerable increase in interest in genetics among medical educators within the past few years. Recent reports have indicated that the curriculum committees of at least a dozen schools of medicine are seriously considering the addition of courses in genetics. One may also recall that Dean McEwen (1952) of the New York College of Medicine, who addressed the fifth annual meeting of this Society, suggested that the teaching of genetics should be included in a proposed Department of Human Biology. This proposal was described in more detail by Sheehan and Harman (1953), and it may be pointed out that Cummins (1943) advocated a similar integrated approach to medical education from the viewpoint of human biology ten years earlier.

The most striking evidence of the interest of medical educators in genetics as a medical subject is provided by the 1954 Teaching Institute of the Association of American Medical Colleges. The Association is sponsoring a series of teaching institutes devoted to discussion and exchange of information concerning curriculum content, teaching methods and faculty and student problems, each institute covering a carefully chosen area of the general curriculum. Representatives from each medical school in the United States and Canada are present at these week-long meetings. The second Teaching Institute, held during October, 1954, was devoted to the subjects of pathology, microbiology, immunology and genetics. The full report of the 1954 Teaching Institute will be published as a supplement to the September, 1955, issue of the *Journal of Medical Education*. As chairman of the subcommittee on genetics, Dr. James V. Neel was largely responsible for the planning of the genetic aspects of this Institute. As genetics was certainly the youngest and least established of the disciplines represented, the first evening of the Institute was devoted to a panel discussion on "Genetics in Medical Education." The geneticists invited as panelists were James V. Neel, William C. Boyd, Bernard D. Davis, John B. Graham, Curt Stern and myself. I must admit that most of this group approached this meeting in a decidedly defensive frame of mind. We expected to be called upon to justify our very existence, and were prepared to attempt to "sell" genetics as a medical subject against heavy and determined opposition to any encroachments on the existing curriculum. As it turned out, we were tilting at windmills. Among the large group in attendance there was practically unanimous agreement that some knowledge of genetics would be quite useful to the practicing physician, and that the schools of medicine have an urgent responsibility to provide this training. In fact, the geneticists were gently chided for not having met this problem more vigorously in the past. The discussions during the next five days of the Teaching Institute did not question the advisability of teaching genetics in the medical school, but were concerned with what to teach, how to teach it, and who should do the teaching.

The Teaching Institutes do not attempt to formulate policy or to recommend specific curriculum changes or teaching methods to the constituent medical schools of the Association. Hence no ready made program or definitive plan of action is to be expected from the discussions of this group. It is recognized that each medical school has its own unique set of facilities, requirements and opportunities, and that each school must seek the solution that fits its own circumstances.

Extended informal discussions tend to crystallize opinion, however. The majority

opinion at the Teaching Institute seemed to favor the establishment of a course in basic principles of genetics of 10 to 12 lecture hours at some time during the first two years of the medical course. Many felt that the genetics course should be correlated with instruction in pathology and microbiology. Additional instruction in the applications of genetics to the clinical subjects is also necessary. While this could be accomplished by a clinical course in hereditary diseases, the majority felt that this could be best accomplished by integrated teaching during the clinical years. Integrated teaching would visualize the geneticist as being present at certain lecture-clinics to discuss the genetic aspects of specific patients or groups of diseases being presented to the third or fourth year students by a clinician. Certain special lectures might also be given by the geneticist as part of existing courses, such as lectures on erythroblastosis or congenital malformations to the obstetrics class. A number of medical schools also feel the need for more instruction in biostatistics, and the possibility of utilizing a geneticist for instruction in this area was discussed. The group also felt that the geneticist should be available for clinical consultations with the staff and for genetic counseling service to patients and their families. The value of heredity clinics, which Professor Dice (1952) discussed in his presidential address to this Society in 1951, was generally recognized. The new book on genetic counseling by our president-elect, Dr. Reed (1955), should prove to be generally useful in connection with the needed clinical services.

The opinions just expressed, which were summarized in a report of the highlights of the Teaching Institute given at the 1954 meeting of the Association of American Medical Colleges (Herndon, 1955), really sound most encouraging. They can be fairly presented as opinions held by a number of persons of responsibility in the administration and curriculum planning of our schools of medicine. But there are also serious difficulties that arise. Two stumbling blocks in the path were particularly emphasized in the discussions of the Teaching Institute. If a school that is now teaching no genetics should add to its staff a full-time medical geneticist to establish a full program, it would be necessary to provide a suitable salary and working facilities. These cost money, and all medical schools have their financial problems. The development of adequate programs of medical genetics in additional schools cannot proceed until the requisite funds become available from some source. While financing is a perpetual headache to deans and other administrative officers, this mere professor has faith that administrations will somehow find funds to support any teaching plan that demonstrates its value, usefulness and practicality.

The second difficulty is in some respects even more serious, and is shared to some degree by all preclinical departments in the medical school. This is the problem of teacher recruitment. There are simply not enough well trained and available medical geneticists to provide staff members for all of the medical schools. Most of the people possessing adequate training in formal genetics and experience in teaching and genetic counseling are now productively employed. Their removal to medical schools would only create vacancies elsewhere. A new supply of well trained professional workers in human genetics is certainly needed. It seems likely that new positions will become available, and that the demand for teachers will exceed the supply.

The participants in the Teaching Institute also discussed the desired qualifications

of instructors in genetics. Some felt that possession of an M.D. degree plus special training in genetics would be most desirable. This group urged that the teacher recruitment program should concentrate on urging interns and assistant residents to obtain special training in genetics. It is difficult at best for purely academic positions to compete with the glamour and financial promise of the private practice of medicine. The supply of teachers from this source is likely to be small indeed in the immediate future, but the widespread establishment of faculty positions in medical genetics may soon encourage young physicians to seek professional careers in this field. Others suggested that the best supply of teachers could be obtained from among those earning a Ph.D. degree in human genetics. It seems certain that there is a place on the medical faculty for the geneticist without medical training. While the geneticist would necessarily be dependent on the clinician in the handling of clinical problems, this is not a serious handicap. While this source of teachers seems more promising, the visible supply still seems to be short of the probable demand of the next several years.

It is thus apparent that the major obstacles to the establishment of additional genetics courses in schools of medicine are two in number: lack of funds and lack of teachers. While both problems would probably wear away gradually with time, the need is immediate and a prompt solution is much to be desired. An ingenious proposal to meet the requirements of the immediate future was made by James V. Neel during the discussions of the Teaching Institute. Neel pointed out that almost every medical faculty contains at least one man whose research or clinical interest has led him into some phase of the field of genetics, and who thus has an interest in the subject. This man may be an ophthalmologist, an orthopedist or a pediatrician in one school, or an anatomist, embryologist or hematologist in another. These people already hold established positions and are trained teachers. With a moderate amount of special training in basic genetic principles, these instructors could initiate new courses in elementary genetics with particular reference to clinical applications, and could hold the fort until an adequate supply of medical geneticists becomes available. Neel has suggested the possibility of organizing a summer work-shop designed to provide these people with the tools necessary for teaching elementary genetics. While a work-shop could not be expected to turn out polished geneticists in a few weeks, a highly concentrated graduate course should be able to cover enough ground to meet the immediate needs of the schools of medicine.

Neel's proposal would require the use of the facilities of one of the larger universities that already has an active program in human genetics. It would require a certain amount of financial support. As the medical schools would profit directly, some indirect help in financing might possibly be expected from them. It is also possible that one or more of the major foundations might become interested in this project. Certainly the idea of training established teachers for an additional and needed specific job should be an attractive one to foundations interested in the progress and improvement of medical instruction. It should also be apparent that no one university now has a staff of geneticists that could furnish the manpower to carry out this proposal. Cooperation of several departments in several universities would be necessary to furnish the required staff of experienced and competent leaders for this work-shop.

Neel's proposal seems to be a well conceived and practical method for training the

instructors in genetics now needed by the schools of medicine. Its greatest weakness is that it would require a phenomenal amount of cooperation between various individuals, universities, and other organizations. It would seem that a plan of this sort could be expected to receive widespread support only if it is sponsored and actively supported by a nation-wide organization with unquestioned altruistic objectives. The only organization with the required prestige and with the wide membership base to speak for human genetics as a scientific discipline is the American Society of Human Genetics. I therefore wish to propose that this Society adopt the policy of active participation in solving the problem of making genetic instruction available to all schools of medicine. I would propose the establishment of a Commission on Education in Medical Genetics, authorized to collect and coordinate information concerning the needs and requirements of the medical schools with regard to curriculum planning and the training and placement of staff members, and to take such action as may be necessary to meet existing requirements. Neel's work-shop proposal described above should be referred to this Commission and exhaustively studied. It is entirely possible that further study might suggest an improved modification of this proposal that would better fit the existing circumstances. It might be possible to work out a long range plan of teacher recruitment and training, with a system of fellowships in medical genetics. This organization could certainly serve as a useful clearing house for information concerning available positions and personnel. A Commission with these objectives would require the active support of all members of the Society, and should be free to call on any member for technical advice or special services. It would be able to cooperate with the Association of American Medical Colleges and with other organizations concerned with medical education. This Commission should be able to make an outstanding contribution to the advancement of medical education and to the continuation of research in human genetics.

We have seen that progress has been slow, but steady, in the introduction of genetics to the medical curriculum during the first half of this century. The progress made has been in large part due to the persistent urging of people of vision, such as Snyder, Macklin, Allan and others, who have repeatedly called attention to the value of genetics in understanding the pathogenesis of disease and its applications in early diagnosis and in prevention of disease. In my opinion a critical period has now been reached. Events of the past few years have aroused great interest in medical genetics among medical faculties and the administrators of medical schools. They apparently see the need for genetics in the medical curriculum, and are seeking methods to satisfy these needs. If we allow this interest to die of frustration, the opportunity may not soon be repeated. I feel that it is the responsibility of the American Society of Human Genetics to seize this opportunity and to provide the technical assistance that the medical schools now desire. I have faith that this Society will regard the present situation as both a challenge and a trust, and that it will not fail to take wise and carefully considered action.

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